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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1 53(b))

Attorney Docket No.	042390.P9907
First Inventor	Curtis E. Jutzi
Title	METHOD AND APPARATUS FOR DETERMINING AND DISPLAYING
Express Mail Label No.	EL466330635US

JC921 U.S. PTO 09/717579 11/21/00

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents

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1. ☒ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)

2. ☐ Applicant claims small entity status.
See 37 CFR 1.27.

3. ☒ Specification [Total Pages 36]
(preferred arrangement set forth below)
- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to sequence listing, a table, or a computer program listing appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (*if filed*)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 6]

5. Oath or Declaration [Total Pages 3]
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(for continuation/divisional with Box 18 completed)
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Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1 63(d)(2) and 1 33(b)

6. ☐ Application Data Sheet. See 37 CFR 1.76

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ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 C.F.R. § 3.73(b) Statement (*when there is an assignee*) ☐ Power of Attorney
11. ☐ English Translation Document (*if applicable*)
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FEE TRANSMITTAL for FY 2000

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TOTAL AMOUNT OF PAYMENT ($) 1,420.00

Complete if Known	
Application Number	
Filing Date	November 21, 2000
First Named Inventor	Curtis E. Jutzi
Examiner Name	
Group/Art Unit	
Attorney Docket No.	042390.P9907

JC921 U.S. PTO 09/717576 11/21/00

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	710.00
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 710.00

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		
Total Claims	55	- 20** =	35	X	18.00	=	$630.00
Independent Claims	4	- 3** =	1	X	80.00	=	$80.00
Multiple Dependent						=	

**or number previously paid, if greater, For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	260	204	135	Multiple Dependent claim, if not paid
109	80	209	40	**Reissue independent claims over original patent
110	18	210	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 710.00

FEE CALCULATION (continued)

3. ADDITIONAL FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	*Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	*Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for response within first month	
116	390	216	195	Extension for response within second month	
117	890	217	445	Extension for response within third month	
118	1,390	218	695	Extension for response within fourth month	
128	1,890	228	945	Extension for response within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,240	241	620	Petition to revive - unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	130	123	130	Petitions related to provisional applications	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	710	249	355	For each additional invention to be examined (37 CFR § 1.129(b))	
179	710	279	355	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) _____

Other fee (specify) _____

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SUBTOTAL (3) ($)

SUBMITTED BY

Complete (if applicable)

Name (Print/Type)	Eric T. King	Registration No. (Attorney/Agent)	44,188	Telephone	(714) 557-3800
Signature				Date	11/21/00

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Our Ref. No. 042390.P9907
Express Mail No. EL466330635US

UNITED STATES PATENT APPLICATION

FOR

METHOD AND APPARATUS FOR DETERMINING AND DISPLAYING THE SERVICE LEVEL OF A DIGITAL TELEVISION BROADCAST SIGNAL

INVENTOR:

Curtis E. Jutzi

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BACKGROUND

1. Field of the Invention

This invention relates to communication systems. In particular, the invention relates to determining and displaying the service level of a digital television broadcast signal.

2. Description of Related Art

Digital Television ("DTV") is a broadcast technology that will transform television, as we now know it. Particularly, DTV is a new "over-the-air" digital television system that will be used by the nearly 1600 local broadcast television stations in the United States. The DTV standard is based on the Advanced Television System Committee (ATSC) Digital Television Standard A/53 (ATSC Doc. A/53, September 6, 1995). With DTV, television pictures, sound, and new data services will be transmitted digitally, rather than as an analog signal. The increased capabilities and new services of DTV are made possible through the use of digital compression techniques that allow more information to be transmitted in the same amount of spectrum used by an existing television channel. The data rate of the DTV signal within the standard 6 MHz broadcast television channel is 19.44 Mbps. This allows for the transmission of programs with very high resolution and sound quality, much better than currently available analog broadcast technology, allowing for movie-quality picture and CD- quality sound and a variety of other enhancements. For example, DTV permits transmission of television programming in new wide screen, high resolution formats known as high definition television (HDTV). In addition, the new DTV television system allows transmissions in standard definition television (SDTV) formats that provide picture resolution similar to existing television service. Not only will

broadcasters be able to broadcast at least one high definition HDTV program, they may also simultaneously transmit SDTV programs using a single television channel.

The DTV system also makes possible the delivery of digital data services to a television and/or computer alone, or simultaneously with, television and audio programming. Of particular interest, beyond the transmission of audio/visual (A/V) information (i.e. the television program), is that these digital broadcast signals from the television networks include additional data that may carry any number of valuable assets. Particularly, the data portion of the digital broadcast signal may carry Advanced Television Enhancement Forum (ATVEF) content (e.g. graphics, video, text, audio, and other types of data) and Streaming Internet Protocol (IP) data (e.g. graphics, video, text, audio, and other types of data). Using this data transmission capability, it will be possible for broadcast stations to send additional data content such as publications (e.g. a local "electronic newspaper"), news, music, program schedules, computer software, or virtually any other type of information/data, at the same time that they transmit regular television programming or in lieu of television programming.

For example, a television network may transmit a financial news show (i.e. the A/V information from the digital broadcast signal) with an announcer talking about what happened to the stock market during the day, simultaneously, the broadcast station can transmit digital data (e.g. graphics, video, text, audio, and other types of data), such as streaming stock quotes, information about a company- e.g. a news story or a picture of the company headquarters, graphs, cartoons, or virtually any type of information, for example, in a window under the announcer. The DTV system also provides the flexibility to support the introduction of new services in the future, as technology and viewer interests continue to develop.

For the compression of video signals, the ATSC DTV Standard requires conformance with the main profile syntax of the Moving Pictures Experts Group (MPEG)-2 video standard. Employing this standard, the amount of data needed to represent television pictures is reduced using a variety of tools, including a motion compensated discrete cosine transform (DCT) algorithm and bi-directional-frame (B-frame) prediction. For the compression of audio signals, conformance with the ATSC DTV Standard A/52 (ATSC Doc.A/52, December 20, 1995) is required, which specifies the Digital Audio Compression (AC-3) Standard. The AC-3 perceptual coding system, which was developed by Dolby Labs, can encode a complete main audio service which includes left, center, right, left surround, right surround, and low frequency enhancement channels into a bit stream at a rate of 384 kilobits per second (kbps).

The service multiplex and transport layer of the ATSC DTV Standard is a compatible subset of the MPEG-2 systems standard that describes a means of delivering a digital data stream in fixed-length "packets" of information. Each packet contains only one type of data: video, audio or ancillary (e.g. data). There is no fixed mix of packet types, which further helps provide flexibility. Channel capacity can be dynamically allocated in the transport layer, under the direct control of the broadcaster. The ATSC DTV Standard has been optimized for terrestrial digital television delivery, where channel bandwidth is limited and transmission errors and data loss are likely. Within the transport layer, the packets of video, audio, closed captioning and any other data associated with a single digital television program are combined using a mechanism to ensure that the sound, pictures and closed captioning information can be synchronized at the receiver. Data describing multiple television programs (e.g. program guide information), or unrelated data for other purposes, are also combined in the transport layer.

A problem with Digital Television (DTV) is that present methods to accurately tune a digital receiver, by determining the best position of the antenna (indoor or outdoor), to receive the "best service level" of a DTV broadcast signal are inadequate. The "best service level" corresponds to the digital receiver receiving the greatest amount of the actual data packets (video, audio, or data) contained within the digital broadcast signal, as possible.

For example, a user can attempt to utilize a video component of the digital broadcast signal to determine the "best service level", but this is very imprecise. Under this scenario, a user when trying to find the best reception for a certain channel, will tune to a channel and adjust their antenna (indoor or outdoor) until what they believe is the "best" video is displayed. The user may adjust their antenna in one direction and find that the video becomes blocky or chunky (indicating missing data packets) and then turn the antenna in the other direction and the video appears to more complete. However, there is no way for the user to be objectively sure that they are indeed getting the "best service level" (i.e. that the greatest amount of data packets of the digital broadcast signal are actually being received) for the best video picture possible. A user could try to tune an antenna based purely on an audio component but this is even more complicated and problematic than the video case.

Moreover, if a viewer wants to obtain a pure data broadcast that has no visual or audio component to use for adjusting their antenna, it is virtually impossible for the user to determine the "best service level", or any sort of service level, to ensure that they are actually receiving the data packets of the digital broadcast signal. Unfortunately, presently, users do not have adequate ways to be objectively sure that they are indeed getting the "best service level" such that they are receiving the greatest amount of data packets of the digital broadcast signal as possible.

Some solutions to determine the degree of service level have been previously utilized with satellite broadcasts. These solutions include using "Signal Strength" and Signal/Noise (Carrier/Noise) ratios. For example, most satellite receivers use "Signal Strength" to identify the best antenna position. However, just because the best signal is found, this does not necessarily mean that the "best service level" has been found. Particularly, although these two solutions may provide an adequate indicator of service level, these solutions are problematic in that neither multi-path interference or other interference patterns can be detected utilizing these solutions. For example, many multi-path interference issues arise with satellite transmissions that utilize 8 VSB (vestigial sideband) and COFDM (Coded Orthogonal Frequency Division Multiplexing) standards. Moreover, these two solutions are only indicators of what the actual data packet error rate (i.e. the data packet loss over time) is. They only measure signal strength and not true transport quality. Accordingly, they do not directly measure the actual data packet error rate and thus the "true" service level.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention will become apparent from the following description of the present invention in which:

Figure 1 is a block diagram illustrating an exemplary environment in which an embodiment of the invention can be practiced.

Figure 2 is a block diagram of certain internal components elements of an exemplary set-top box environment in which one embodiment of the present invention including a service level determiner can be implemented.

Figure 3 is a flowchart illustrating a process for determining and displaying the "best service level" for a digital television broadcast signal according to one embodiment of the present invention.

Figure 4 illustrates an example of an MPEG-2 transport stream having an IP data test stream component according to one embodiment of the present invention.

Figure 5 illustrates an example of an IP data test stream according to one embodiment of the present invention.

Figure 6 illustrates a receiver device to display the service level of the incoming digital television broadcast signal according to one embodiment of the invention.

Figure 7 illustrates the receiver device displaying a "best service level" of the incoming digital television broadcast signal according to one embodiment of the invention.

DESCRIPTION

The present invention provides a method, apparatus, and system for determining and displaying the service level of a digital television (DTV) broadcast signal. Particularly, in one embodiment of the invention, a digital television receiver receives a digital television broadcast signal. The digital television broadcast signal can include data packets containing video, audio and other data components. Also, the digital television broadcast signal includes a data test stream composed of a plurality of data packets. A service level determiner is used to determine a service level of the digital television broadcast signal based upon a loss of data packets from the data test stream. The service level determiner additionally causes a representation of the service level to be displayed.

In one embodiment of the present invention, the data test stream can be an Internet Protocol (IP) based data test stream locatable on a given Packet Identifier (PID) of the digital broadcast signal, in which, the IP based data test stream includes sequentially numbered packets. Also, in some embodiments, the IP data test stream can have a fixed IP address allowing any digital television receiver capable of receiving IP data test streams to acquire and process it. The service level determiner determines a data packet loss percentage value for the data test stream by calculating the ratio of the measured number of data packets received by the digital receiver and the number of data packets that should have been received by the digital receiver. This can occur over a predetermined interval of time or number of packets. The service level determiner maps the data packet loss percentage value of the data test stream into a service level diagnostic that can be displayed on a display device, such as a television, as a service level diagnostic indicator, to indicate the service level of the digital television broadcast signal. The displayed service level diagnostic indicator can be updated at predetermined intervals (e.g. time or number

of packets) to allow a user to place their antenna in a best service level position to receive the "best service level" as indicated by the service level diagnostic indicator. The "best service level" corresponds to the digital receiver receiving the greatest amount of the data test stream contained within the digital television broadcast signal as possible. The service level determiner can be used for digital television broadcast signals communicated from either a terrestrial broadcast station or communicated via a satellite network, as well as, by other types of communication media.

The present invention provides an advantage in that it provides an objective measure for the user to be sure that they are indeed getting the "best service level" (i.e. that the greatest amount of data packets of the data test stream of the digital television broadcast signal are actually being received) to ensure that the user obtains the best delivery of video, audio, or other data components possible from the digital television broadcast signal. Additionally, if a viewer wants to obtain a pure data broadcast that has no visual or audio component to use for adjusting their antenna, the present invention provides an objective measure to tune their antenna to receive the "best service level" for receiving the greatest number of data packets of the pure data broadcast.

Furthermore, because the present invention directly measures the actual data packet loss (i.e. the error rate) of the data test stream a "true" service level is displayed to the user. The present invention accomplishes this with a very simple and elegant solution by directly measuring the data packet error rate of an IP data test stream. Accordingly, DTV Broadcasters can simply provide an IP data test stream in their broadcast to easily allow users to adjust their antennas to receive a digital broadcast having the "best service level" possible. Also, this solution enables IP data to be sent to users in all ATSC/DTV markets and could possibly

accelerate the deployment of free data broadcasting to metropolitan areas of the U.S. and all over the world.

In the following description, the various embodiments of the present invention will be described in detail. However, such details are included to facilitate understanding of the invention and to describe exemplary embodiments for implementing the invention. Such details should not be used to limit the invention to the particular embodiments described because other variations and embodiments are possible while staying within the scope of the invention. Furthermore, although numerous details are set forth in order to provide a thorough understanding of the present invention, it will be apparent to one skilled in the art that these specific details are not required in order to practice the present invention. In other instances details such as, well-known electrical structures and circuits, are shown in block diagram form in order not to obscure the present invention.

Figure 1 is a block diagram illustrating an exemplary environment 100 in which an embodiment of the invention can be practiced. As shown in Figure 1, a video source 102 (e.g. a television network such as NBC) having a satellite transmitter 103 transmits a digital television broadcast signal 104 to a satellite 106 that in turn relays the digital television broadcast signal 104 to a satellite antenna 110 of a ground based Broadcast Network Operating Center (NOC) 112 or to a satellite antenna 116 of a house 118 that is equipped to receive direct broadcast satellite transmissions (e.g. Digital Video Broadcasting (DVB), DirectTV, etc.). Typically, a Broadcast NOC 112 aggregates and transmits the network's digital television broadcast signal 104 via a transmitter 121 to a house 122 having an antenna 124 for receipt of the digital television broadcast signal 104. In either case, direct satellite transmission or terrestrial broadcast, the digital television broadcast signal 104 is received by a receiver device 130 having

a display device, typically a television 132 having a set-top box 134 to decode the digital television broadcast signal. Alternatively, the receiver device 130 could be a computer with a computer monitor. The digital television broadcast signal 104 includes audio and video (A/V) information (e.g. a television program), as well as, pure data components. Many television networks digitally broadcast their television programs in new wide screen high definition television HDTV formats, as well as, in standard definition television SDTV formats.

Most television networks broadcast their digital television broadcast signal 104 from a video source 102 utilizing the MPEG-2 transport format that delivers a digital data stream in fixed-length "packets" of information. Each packet contains only one type of data: video, audio or ancillary (e.g. data). Particularly, many television networks transmit their digital television broadcast signals in accordance with Digital Video Broadcasting (DVB) standards set by the European Telecommunications Standards Institute or the Advanced Television System Committee (ATSC) standards (e.g. ATSC Modulation and Coding Requirements for Digital TV (DTV) Applications over Satellite A/80 standard (ATSC Doc. A/80, July 17, 1999)). The DVB standard specifies the MPEG-2 format for video, audio, and transport. The ATSC standard specifies the MPEG-2 format for video, the Digital Audio Compression (AC-3) Standard for audio, and identifies the MPEG-2 format as a means of transport, but it is not limited to this format. Additionally, television networks also broadcast analog television broadcast signals from a video source 102 conforming to the National Television Standards Committee (NTSC) standard.

Terrestrial Digital TV (DTV) Broadcast Network Operating Centers (NOC) 112 conforms to the standards set forth in the Advanced Television System Committee (ATSC) Digital Television Standard A/53 (ATSC Doc. A/53, September 16, 1995) for transmitting the

digital television broadcast signal 104. For the compression of video signals, the ATSC DTV Standard requires conformance with the main profile syntax of the Moving Pictures Experts Group (MPEG)-2 video standard. For the compression of audio signals, conformance with the ATSC DTV Standard A/52 (ATSC Doc.A/52, December 20, 1995) is required, which specifies the Digital Audio Compression (AC-3) Standard.

Digital Television (DTV) also makes possible the delivery of digital data services to a television and/or computer alone, or simultaneously with, television and audio programming. Of particular interest, beyond the transmission of audio/visual (A/V) information (i.e. the television program), is that these digital broadcast signals from the television networks include additional data that may carry any number of valuable assets. Particularly, the data portion of the digital broadcast signal may carry Advanced Television Enhancement Forum (ATVEF) content (e.g. graphics, video, text, audio, and other types of data) and Streaming Internet Protocol (IP) data (e.g. graphics, video, text, audio, and other types of data). Using this data transmission capability, it will be possible for broadcast stations to send additional data content such as publications (e.g. a local "electronic newspaper"), news, music, program schedules, computer software, or virtually any other type of information/data, at the same time that they transmit regular television programming or in lieu of television programming. For example, a television network may transmit a financial news show (i.e. the A/V information from the digital broadcast signal) with an announcer talking about what happened to the stock market during the day, simultaneously, the broadcast station can transmit digital data (e.g. graphics, video, text, audio, and other types of data), such as streaming stock quotes, information about a company- e.g. a news story or a picture of the company headquarters, graphs, cartoons, or virtually any type of information, for example, in a window under the announcer. The DTV system also provides the

flexibility to support the introduction of new services in the future, as technology and viewer interests continue to develop.

A current problem with Digital Television (DTV) is that present methods to accurately tune a digital receiver, by determining the best position of the antenna (indoor or outdoor), to receive the "best service level" of a DTV broadcast signal are inadequate. The "best service level" corresponds to the digital receiver receiving the greatest amount of the actual data packets (video, audio, or data) contained within the digital broadcast signal as possible. Fortunately, the present invention provides a method, apparatus, and system for determining and displaying the "best service level" of a digital television (DTV) broadcast signal. Particularly, the present invention includes a service level determiner to determine a service level of the digital television broadcast signal based upon a loss of data packets (i.e. error rate) from the data test stream and additionally causes a representation of the service level to be displayed.

Figure 2 shows a block diagram of certain internal components elements 200 of an exemplary set-top box 134 environment in which one embodiment of the present invention including a service level determiner 204 can be implemented. The internal elements 200 include a digital television receiver 210, a processor 220, a non-volatile memory 230, a decoder unit 240, and a system memory 250. The set-top box 134 implementing the service level determiner 204 can be used to determine a service level of an incoming digital television broadcast signal 104 based upon a loss of data packets (i.e. error rate) from a data test stream. Further, the exemplary set-top box 134 implementing the service level determiner 204 can be used to display a service level diagnostic indicator representative of the service level of the digital broadcast signal 104 to be displayed upon a display device 132, such as a television. Also, additional elements that may be used with the set-top box 134 will be discussed. Furthermore, it is contemplated that set-top

box 134 implementing the service level determiner 204 may employ other elements but these elements are not shown in order to avoid obscuring the invention.

Herein, the digital television receiver 210 receives the digital television broadcast signal 104. The digital television broadcast signal 104 can include data packets containing video, audio and other data components. Also, the digital television broadcast signal includes a data test stream composed of a plurality of data packets. In one embodiment of the present invention, the data test stream can be an Internet Protocol (IP) based data test stream locatable on a given Packet Identifier (PID) of the digital broadcast signal, in which, the IP based data test stream includes sequentially numbered packets. The digital television receiver 210 includes a tuner that extracts the incoming content of the digital television broadcast signal 104 for a particular channel. Moreover, the digital television receiver 210 may support requests that certain segments of content from the digital television broadcast signal 104 be displayed. Additionally, the digital television receiver 210 may include an interface (I/F) controller 212 to detect signals 214 (e.g., IR signals) from a remote control unit commanding it to tune to a certain channel or to perform other functions. As shown, the digital television receiver 210 is coupled to the processor 220.

The processor 220 is a logic unit for processing information for the set-top box 134. Particularly, the processor 220 processes information in order to implement the functions of the service level determiner 204, such as, to determine a service level of the digital television broadcast signal based upon a loss of data packets (i.e. error rate) from the data test stream and to additionally cause a representation of the service level to be displayed. Moreover, the processor 220 processes information in order to implement all the other functions of the service level determiner and the other functions of the invention, as will be discussed in detail later, as well as,

the many other functions of the set-top box 134. As illustrative examples, the "processor" may include a digital signal processor, a microcontroller, a state machine, or even a central processing unit having any type of architecture, such as complex instruction set computers (CISC), reduced instruction set computers (RISC), very long instruction word (VLIW), or hybrid architecture. In this embodiment, the processor 220 is shown as a single logic unit; however, it is contemplated that the processor 220 may be at least two or more processors operating as a collective unit. As shown, the processor 220 is coupled to non-volatile memory 230, the decoder unit 240, and system memory 250.

The non-volatile memory 230 features any memory that can retain its contents when the set-top box 134 is powered down. Examples of the non-volatile memory include a hard disk, flash memory, battery-backed random access memory, Read-only-Memory (ROM) and the like. Particularly, in one embodiment of the invention, the instructions/code segments to implement the various functions of the service level determiner 204, as will be discussed, can be stored in the non-volatile memory 230.

The decoder unit 240 is logic that decodes incoming content- e.g. the incoming digital television broadcast signals 104. As previously discussed, the digital television broadcast signals 104 are placed in an encoded (or compressed) format prior to transmission from the content providers- e.g. the television networks. Examples of the compressed format include a Motion Picture Experts Group format such as MPEG-2. The decoder unit 240 is further configured to convert the content to an appropriate display format such as National Television System Committee (NTSC) Standard of the Electronics Industries Association. Particularly, the decoder unit 240 can decode the video, audio, or other data components of the digital television broadcast signal 104 for display and/or processing by the processor 220. Moreover, the decoder unit can

decode the data test stream of the digital broadcast signal to be used by the processor 220 and the service level determiner 204 to determine a service level of the digital television broadcast signal. Output from the decoder unit 240 can also be used for other functions. Of course, it is contemplated that the content may be routed through the decoder unit 240 without undergoing any operations if the content is not placed in an encoded format.

System memory 250 is a device that is adapted to store digital information. The system memory 250 can be used to store system code, data, programs- such as an operating system for the set-top box 134, and can be used in implementing the service level determiner 204 of the present invention. The system memory 140 can be implemented with random access memory (RAM), dynamic random access memory (DRAM) or static random access memory (SRAM), etc. or any combination thereof, or any other type of memory.

The set-top box 134 may also include numerous other elements. For example, set-top box 134 may include a keyboard 254 for the input of data from a user. The set-top box 134 may include a network interface card 256 to bi-directionally couple the set-top box to a computer network 258 such as the Internet. Furthermore, the set-top box 134 may include a plurality of other Input/Output devices 260 to perform I/O functions. The I/O devices 160 can include a monitor, a modem, a printer, or any other types of I/O devices, e.g., controllers for input devices (mouse, trackball, pointing device), media cards (e.g., audio, video, graphics), other network cards, other peripheral controllers, a hard disk, a floppy drive, an optical digital storage device, a magneto-electrical storage device, DVD, CD-ROM, etc., or any combination thereof.

The exemplary set-top box 134 of Figure 2 is only an example of environment that the service level determiner 204 according to one embodiment of the invention can be practiced with. It should be appreciated the present invention can be practiced with any sort of set-top

box, can be implemented purely in hardware such as a hardware card (e.g. useable with a set-top box, a television, a receiver, a computer, etc.), can be implemented with any sort of computing device such as: a personal computer, server computer, workstation, minicomputer, laptop, desktop, hand held computing device, palm pilot, etc., or basically any sort of device that includes circuitry capable of processing data. In particular, in one embodiment of the present invention, the service level determiner 204 can be generally implemented in a set-top box having a processor, as one or more instructions (e.g. code segments), to perform the desired functions. The instructions which when read and executed by a processor, cause the processor to perform the operations necessary to implement and/or use the present invention. Generally, the instructions are tangibly embodied in and/or readable from a machine-readable medium, device, or carrier such as memory, data storage devices, and/or a remote device coupled to the set-top box via data communication devices. The instructions may be loaded from memory, data storage devices, and/or remote devices into the memory of the set-top box for use during operations.

Those skilled in the art will recognize that the exemplary environments illustrated in Figures 1 in 2 are not intended to limit the present invention. Indeed, those skilled in the art will recognize that other alternative system environments may be used without departing from the scope of the present invention.

Various methods, processes, procedures and/or algorithms will now be discussed to implement certain aspects of the invention.

Figure 3 is a flowchart illustrating a process 300 for determining and displaying the "best service level" for a digital television broadcast signal according to one embodiment of the present invention. First, the process 300 receives a digital television broadcast signal (block 310). As previously discussed, the digital television broadcast signals may conform to Advance

Television System Committee (ATSC) standards for terrestrial digital television broadcasts or Digital Video Broadcasting (DVB) standards for direct satellite transmissions, both of which utilize MPEG-2 transport formats to deliver a digital stream in fixed-length packets of information. Each packet contains only one type of data: a video, audio or ancillary (e.g. data). However, it should be appreciated, that digital television broadcast signals may conform to other types of standards. Moreover, the digital television broadcast signal can include a data test stream composed of a plurality of data packets.

In one embodiment of the invention, the data test stream can be an Internet Protocol (IP) based data test stream locatable on a given Packet Identifier (PID) of the digital broadcast signal having sequentially numbered packets. (Block 310). For example, ATSC Program and System Information Protocol (PSIP) for Terrestrial Broadcast and Cable A/65 (ATSC Doc. A/65, December 23, 1997) defines a Standard for System Information (SI) and Program Guide (PG) data compatible with digital multiplex bit streams constructed in accordance with MPEG-2. Particularly, it provides a standardized format for transmitting data about current and future programs using private data sections in the transport stream that can be acquired and processed by suitably equipped digital receivers.

Continuing with the current example, in one embodiment of the invention, the data test stream can be located on a given PID which can be identified using the PSIP data of the MPEG2 digital broadcast stream from a particular station. Figure 4 illustrates an example of an MPEG-2 transport stream 400 having an IP data test stream component according to one embodiment of the present invention. Particularly, Figure 4 shows the video component 402 of the stream, the audio component 404 of the stream, the data component 406 of the stream, and an IP data test stream component 408 of the stream. Thus, a digital receiver can locate and latch to a PID

containing the IP data test stream component 408 and acquire and process the IP data test stream data (in conjunction with a service level determiner) to determine a service level for the digital television signal, as will be discussed. Also, in some embodiments, the IP data test stream can have a fixed IP address allowing any digital receiver that is capable of receiving IP data streams on an MPEG-2 transport to acquire it and process it to aid in determining the service level of the digital broadcast signal. In some embodiments, the PID for the data test stream can be fixed. Further, any suitable data test stream on any type of format for a digital television broadcast signal could be used as long as it can be acquired and processed by a digital receiver.

Figure 5 shows an example of an IP data test stream 500 that can be used according to one embodiment of the present invention. The IP data test stream 500 of the MPEG-2 transport stream shown in Figure 5 can include sequentially numbered IP data packets (e.g. SEQ#=n, SEQ#=n+1, SEQ#=n+2, SEQ#=n+3, etc.) that can be used to help identify the number of packets received, as well as, the total packets lost during a given interval (e.g. time or number of packets), to determine the service level, as will be discussed. Basically, the service level is determined for the digital television broadcast signal based upon a loss of data packets from the data test stream (i.e. the error rate).

Returning to Figure 3, the process 300 next measures the number of packets of the IP data packet test stream received over a predetermined interval (e.g. time or number of packets), (block 320). Next, the process 300 determines the IP data packet loss percentage value for the IP data packet test stream by calculating the ratio of the measured number of data packets of the IP data packet test stream received over the interval and the number of data packets of the IP data packet test stream that should have been received over the interval (block 330). This ratio yields the IP packet loss percentage value (i.e. the error rate) and corresponds to the service level of the

digital television broadcast signal. The process 300 then maps the IP packet loss percentage value into a service level diagnostic (block 340). For example, if the IP data packet stream was delivered at a rate of 100 packets over a predetermined interval of one second then the service level could be easily mapped into a known service level diagnostic between 0 and 100. Accordingly, if the measured number is 50 packets, compared to the 100 packets that should have been received, then the service level diagnostic would be 50. On the other hand, if the measured number is 97 packets, then the service level diagnostic would be 97, or, if the measured number is 100 packets then the service level diagnostic would be 100, etc. Of course, it should be appreciated that many other mappings are possible.

The process 300 then displays a service level diagnostic indicator corresponding to the service level diagnostic, previously calculated (block 350). Particularly, in some embodiments, the process 300 displays the service level diagnostic indicator upon a display device, such as a television, to indicate the service level of the digital television broadcast signal.

Figure 6 shows a receiver device to display the service level of the incoming digital broadcast signal according to one embodiment of the invention. As previously discussed with reference to Figure 1, the receiver device 130 includes a display device, typically a television 132, having a set-top box 134 to decode the digital television broadcast signal. As shown, the set-top box 134 may be receiving the digital television broadcast signal from a standard antenna (e.g. terrestrial DTV broadcast) or a satellite antenna (e.g. satellite transmission). The set-top box 134 may also include system interface (I/F) 601 and/or a remote control (not shown) to provide viewer control of the content displayed on the television. Also, the set-top box 134 may be coupled to a computer network such as the Internet. The television 132 displays the digital television broadcast signal and a service level diagnostic indicator 602. In this embodiment, the

service level diagnostic indicator is shown as a rectangular bar shaped meter indicating a service level range from 0% to 100%. However, it should be appreciated, that any sort of service level diagnostic indicator that is capable of displaying a service level range can be used.

Particularly, as shown in Figure 6, the service level diagnostic indicator reads 50% indicating that there is a 50% error rate in the receipt of the IP data packet test stream. This indicates that the television 132 is probably only receiving half of the digital television broadcast signal and is thus receiving bad video, audio, and data reception. In this case, the video picture on the television 132 would appear blocky or chunky indicating missing data packets. However, in a pure data broadcast, with no video or audio component, but for the service level diagnostic indicator 602 of the present invention, the user would have no way of knowing that they are only receiving half of the needed data.

Returning to Figure 3, the process 300 updates the service level diagnostic indicator at predetermined intervals (e.g. a period of time or a predetermined number of packets) to allow a user to place their antenna in a best service level position to receive the "best service level" possible as indicated by the service level diagnostic indicator. The "best service level" corresponds to the digital receiver receiving the greatest amount of the IP data test stream contained within the digital television broadcast signal as possible to ensure that the user obtains the best delivery of video, audio, or other data components possible from the digital television broadcast signal.

Figure 7 illustrates the receiver device displaying a "best service level" of the incoming digital broadcast signal according to one embodiment of the invention. Thus, as shown in Figure 7, the present invention allows a user to move their antenna until the service level diagnostic indicator 602 reaches 100% indicating to the user that they are receiving all of the data contained

within the digital television broadcast signal to receive the "best service level" possible. This ensures the user that they are indeed receiving the best video picture, the best audio sound, and best data download possible.

The present invention provides an advantage in that it provides an objective measure for the user to be sure that they are indeed getting the "best service level" (i.e. that the greatest amount of data packets of the data test stream of the digital television broadcast signal are actually being received) to ensure that the user obtains the best delivery of video, audio, or other data components possible from the digital television broadcast signal. Additionally, if a viewer wants to obtain a pure data broadcast that has no visual or audio component to use for adjusting their antenna, the present invention provides an objective measure to tune their antenna to receive the "best service level" for receiving the greatest number of data packets of the pure data broadcast.

Furthermore, because the present invention directly measures the actual data packet loss (i.e. the error rate) of the data test stream a "true" service level is displayed to the user. The present invention accomplishes this with a very simple and elegant solution by directly measuring the data packet error rate of an IP data test stream. Accordingly, DTV Broadcasters can simply provide an IP data test stream in their broadcast to easily allow users to adjust their antennas to receive a digital broadcast having the best service level possible. Also, this solution enables IP data to be sent to users in all ATSC/DTV markets and could possibly accelerate the deployment of free data broadcasting to metropolitan areas of the U.S. and all over the world.

While the present invention and its various functional components been described in particular embodiments, it should be appreciated the present invention can be implemented in hardware, software, firmware, middleware or a combination thereof and utilized in systems,

subsystems, components, or sub-components thereof. When implemented in software, the elements of the present invention are the instructions/code segments to perform the necessary tasks. The program or code segments can be stored in a machine readable medium, such as a processor readable medium or a computer program product, or transmitted by a computer data signal embodied in a carrier wave, or a signal modulated by a carrier, over a transmission medium or communication link. The machine-readable medium or processor-readable medium may include any medium that can store or transfer information in a form readable and executable by a machine (e.g. a processor, a computer, etc.). Examples of the machine/processor-readable medium include an electronic circuit, a semiconductor memory device, a ROM, a flash memory, an erasable programmable ROM (EPROM), a floppy diskette, a compact disk CD-ROM, an optical disk, a hard disk, a fiber optic medium, a radio frequency (RF) link, etc. The computer data signal may include any signal that can propagate over a transmission medium such as electronic network channels, optical fibers, air, electromagnetic, RF links, etc. The code segments may be downloaded via computer networks such as the Internet, Intranet, etc.

In particular, in one embodiment of the present invention, the service level determiner can be generally implemented in a set-top box, to perform the desired operations, functions, and processes as previously described.

The instructions (e.g. code segments) when read and executed by the set-top box, cause the set-top box to perform the operations necessary to implement and/or use the present invention. Generally, the instructions are tangibly embodied in and/or readable from a device, carrier, or media, such as memory, data storage devices, and/or a remote device coupled to the computer via data communication devices. The instructions may be loaded from memory, data

storage devices, and/or remote devices into the memory of the set-top box for use during operations.

Thus, the service level determiner according to one embodiment of the present invention may be implemented as a method, apparatus, or machine-readable medium (e.g. a processor readable medium or a computer readable medium) using standard programming and/or engineering techniques to produce software, firmware, hardware, middleware, or any combination thereof. The term "machine readable medium" (or alternatively, "processor readable medium" or "computer readable medium") as used herein is intended to encompass a medium accessible from any machine/process/computer for reading and execution. Of course, those skilled in the art will recognize that many modifications may be made to this configuration without departing from the scope of the present invention.

While this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications of the illustrative embodiments, as well as other embodiments of the invention, which are apparent to persons skilled in the art to which the invention pertains are deemed to lie within the spirit and scope of the invention.

What is claimed is:

1. An apparatus comprising:

a digital television receiver to receive a digital television broadcast signal, the digital television broadcast signal including a data test stream having a plurality of data packets; and

a service level determiner to determine a service level of the digital television broadcast signal based upon a loss of data packets from the data test stream and to cause the service level to be displayed.

2. The apparatus of claim 1, wherein the data test stream is an Internet Protocol (IP) based data test stream.

3. The apparatus of claim 1, wherein the data test stream is an Internet Protocol (IP) based data test stream locatable on a given Packet Identifier (PID) of the digital television broadcast signal and the IP based data test stream includes sequentially numbered packets.

4. The apparatus of claim 1, wherein the service level determiner measures a number of data packets of the data test stream received by the digital television receiver over a predetermined interval.

5. The apparatus of claim 4, wherein the service level determiner determines a data packet loss percentage value for the data test stream by calculating a ratio of the measured

number of data packets received by the digital receiver and a number of data packets that should have been received by the digital receiver.

6. The apparatus of claim 5, wherein the service level determiner maps the data packet loss percentage value of the data test stream into a service level diagnostic.

7. The apparatus of claim 6, further comprising a display device to display a service level diagnostic indicator based upon the service level diagnostic to indicate the service level of the digital television broadcast signal.

8. The apparatus of claim 1, further comprising a display device to display a service level diagnostic indicator based upon the loss of data packets from the data test stream to indicate the service level of the digital television broadcast signal.

9. The apparatus of claim 8, wherein the service level diagnostic indicator is a bar shaped meter indicating a service level range from 0% to 100%.

10. The apparatus of claim 8, wherein the service level diagnostic indicator is updated at predetermined intervals.

11. The apparatus of claim 8, wherein the display device is a television.

12. The apparatus of claim 1, wherein the digital television broadcast signal is communicated from a terrestrial broadcast station.

13. The apparatus of claim 1, wherein the digital television broadcast signal is communicated via a satellite network.

14. The apparatus of claim 1, wherein the service level determiner is implemented with a set-top box.

15. A method comprising:

receiving a digital television broadcast signal that includes a data test stream having a plurality of data packets;

determining a service level of the digital television broadcast signal based upon a loss of data packets from the data test stream; and

displaying the service level.

16. The method of claim 15, wherein the data test stream is an Internet Protocol (IP) based data test stream.

17. The method of claim 15, wherein the data test stream is an Internet Protocol (IP) based data test stream locatable on a given Packet Identifier (PID) of the digital television broadcast signal and the IP based data test stream includes sequentially numbered packets.

18. The method of claim 15, wherein determining the service level of the digital television broadcast signal service further comprises:

measuring a number of data packets of the data test stream received by the digital television receiver over a predetermined interval.

19. The method of claim 18, wherein determining the service level of the digital television broadcast signal further comprises:

determining a data packet loss percentage value for the data test stream by calculating a ratio of the measured number of data packets received by the digital receiver and a number of data packets that should have been received by the digital receiver.

20. The method of claim 19, wherein determining the service level of the digital television broadcast signal service further comprises:

mapping the data packet loss percentage value of the data test stream into a service level diagnostic representative of the service level of the digital television broadcast signal.

21. The method of claim 20, wherein displaying the service level of the digital television broadcast signal service further comprises:

displaying a service level diagnostic indicator based upon the service level diagnostic to indicate the service level of the digital television broadcast signal.

22. The method of claim 15, wherein displaying the service level of the digital television broadcast signal service further comprises:

displaying a service level diagnostic indicator based upon the loss of data packets from the data test stream on a display device to indicate the service level of the digital television broadcast signal.

23. The method of claim 22, wherein the service level diagnostic indicator is a bar shaped meter indicating a service level range from 0% to 100%.

24. The method of claim 22, wherein displaying the service level of the digital television broadcast signal service further comprises:

updating the service level diagnostic indicator at predetermined intervals.

25. The method of claim 22, wherein the display device is a television.

26. The method of claim 15, wherein the digital television broadcast signal is communicated from a terrestrial broadcast station.

27. The method of claim 15, wherein the digital television broadcast signal is communicated via a satellite network.

28. The method of claim 15, wherein determining the service level of the digital television broadcast signal and displaying the service level is implemented with a set-top box.

29. A machine-readable medium having stored thereon instructions, which when executed by a processor, causes the processor to perform the following:

receiving a digital television broadcast signal that includes a data test stream having a plurality of data packets;

determining a service level of the digital television broadcast signal based upon a loss of data packets from the data test stream; and

displaying the service level.

30. The machine-readable medium of claim 29, wherein the data test stream is an Internet Protocol (IP) based data test stream.

31. The machine-readable medium of claim 29, wherein the data test stream is an Internet Protocol (IP) based data test stream locatable on a given Packet Identifier (PID) of the digital television broadcast signal and the IP based data test stream includes sequentially numbered packets.

32. The machine-readable medium of claim 29, wherein determining the service level of the digital television broadcast signal service further comprises:

measuring a number of data packets of the data test stream received by the digital television receiver over a predetermined interval.

33. The machine-readable medium of claim 32, wherein determining the service level of the digital television broadcast signal further comprises:

determining a data packet loss percentage value for the data test stream by calculating a ratio of the measured number of data packets received by the digital receiver and a number of data packets that should have been received by the digital receiver.

34. The machine-readable medium of claim 33, wherein determining the service level of the digital television broadcast signal service further comprises:

mapping the data packet loss percentage value of the data test stream into a service level diagnostic representative of the service level of the digital television broadcast signal.

35. The machine-readable medium of claim 34, wherein displaying the service level of the digital television broadcast signal service further comprises:

displaying a service level diagnostic indicator based upon the service level diagnostic to indicate the service level of the digital television broadcast signal.

36. The machine-readable medium of claim 29, wherein displaying the service level of the digital television broadcast signal service further comprises:

displaying a service level diagnostic indicator based upon the loss of data packets from the data test stream on a display device to indicate the service level of the digital television broadcast signal.

37. The machine-readable medium of claim 36, wherein the service level diagnostic indicator is a bar shaped meter indicating a service level range from 0% to 100%.

38. The machine-readable medium of claim 36, wherein displaying the service level of the digital television broadcast signal service further comprises:

updating the service level diagnostic indicator at predetermined intervals.

39. The machine-readable medium of claim 36, wherein the display device is a television.

40. The machine-readable medium of claim 29, wherein the digital television broadcast signal is communicated from a terrestrial broadcast station.

41. The machine-readable medium of claim 29, wherein the digital television broadcast signal is communicated via a satellite network.

42. The machine-readable medium of claim 29, wherein determining the service level of the digital television broadcast signal and displaying the service level is implemented with a set-top box.

43. A system comprising:

a set-top box including,

a digital television receiver to receive a digital television broadcast signal, the digital television broadcast signal including a data test stream having a plurality of data packets; and

a service level determiner to determine a service level of the digital television broadcast signal based upon a loss of data packets from the data test stream and to cause the service level to be displayed; and

a display device to display the digital television broadcast signal and the service level.

44. The system of claim 43, wherein the data test stream is an Internet Protocol (IP) based data test stream.

45. The system of claim 43, wherein the data test stream is an Internet Protocol (IP) based data test stream locatable on a given Packet Identifier (PID) of the digital television broadcast signal and the IP based data test stream includes sequentially numbered packets.

46. The system of claim 43, wherein the service level determiner measures a number of data packets of the data test stream received by the digital television receiver over a predetermined interval.

47. The system of claim 46, wherein the service level determiner determines a data packet loss percentage value for the data test stream by calculating a ratio of the measured number of data packets received by the digital receiver and a number of data packets that should be received by the digital receiver.

48. The system of claim 47, wherein the service level determiner maps the data packet loss percentage value of the data test stream into a service level diagnostic.

49. The system of claim 48, wherein the display device displays a service level diagnostic indicator based upon the service level diagnostic to indicate the service level of the digital television broadcast signal.

50. The system of claim 43, wherein the display device displays a service level diagnostic indicator based upon the loss of data packets from the data test stream to indicate the service level of the digital television broadcast signal.

51. The system of claim 50, wherein the service level diagnostic indicator is a bar shaped meter indicating a service level range from 0% to 100%.

52. The system of claim 50, wherein the service level diagnostic indicator is updated at predetermined intervals.

53. The system of claim 43, wherein the display device is a television.

54. The system of claim 43, wherein the digital television broadcast signal is communicated from a terrestrial broadcast station.

55. The system of claim 43, wherein the digital television broadcast signal is communicated via a satellite network.

ABSTRACT OF THE DISCLOSURE

The present invention provides a method, apparatus, and system for determining and displaying the service level of a digital television broadcast signal. A digital television receiver receives a digital television broadcast signal. The digital television broadcast signal includes a data test stream composed of a plurality of data packets. A service level determiner is used to determine a service level of the digital television broadcast signal based upon a loss of data packets from the data test stream (i.e. the error rate). The service level determiner additionally causes a representation of the service level to be displayed as a service level diagnostic indicator on a display device, such as a television. The service level diagnostic indicator can be updated at predetermined intervals to allow a user to place their antenna in a best service level position to receive the best service level as indicated by the service level diagnostic indicator.

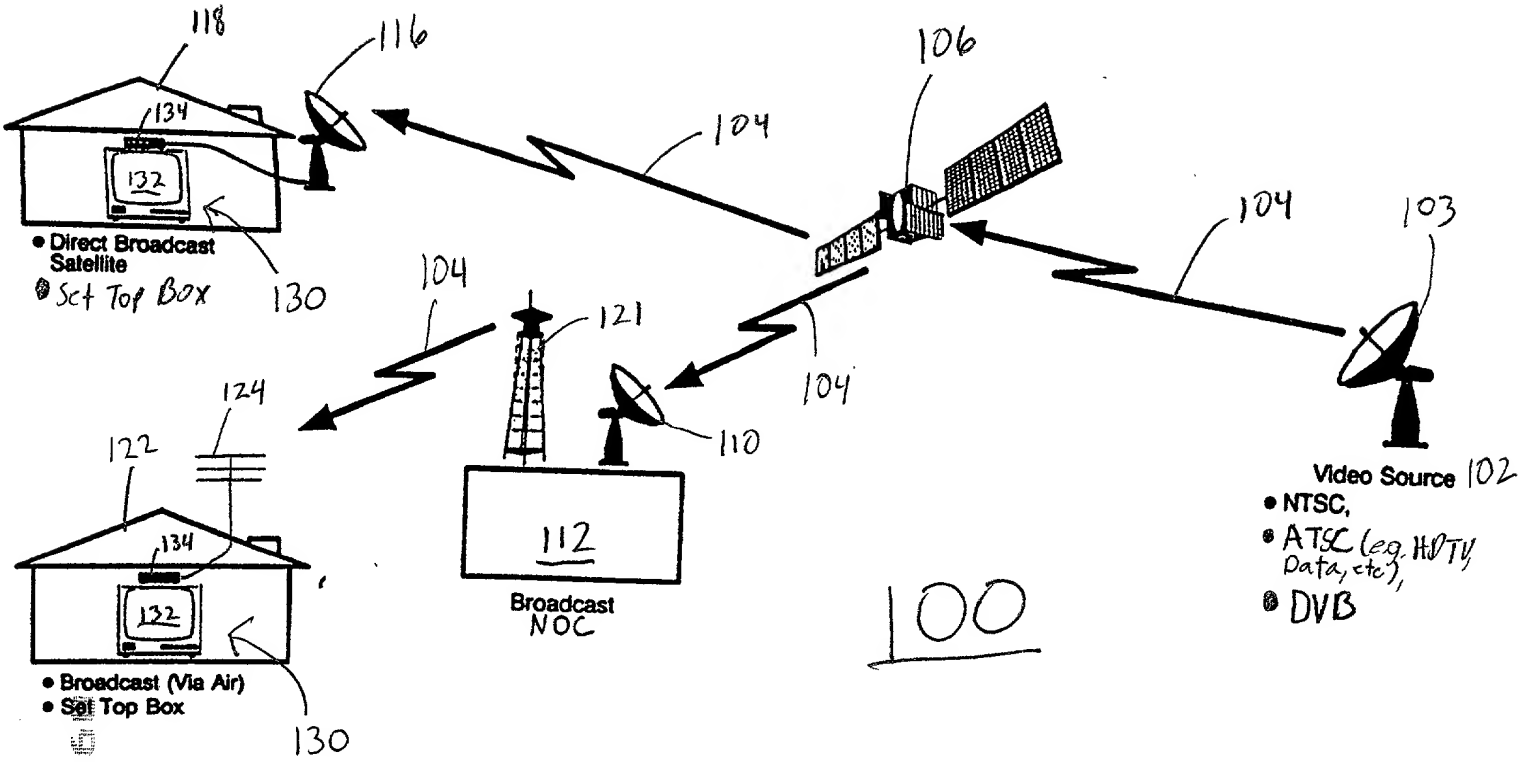
118
116
106
134
132
104
104
103
Direct Broadcast Satellite
Set Top Box
130
104
121
104
124
110
122
Video Source 102
NTSC,
ATSC (eg. HDTV Data, etc),
DVB
112
Broadcast NOC
100
134
122
Broadcast (Via Air)
Set Top Box
130

FIG. 1

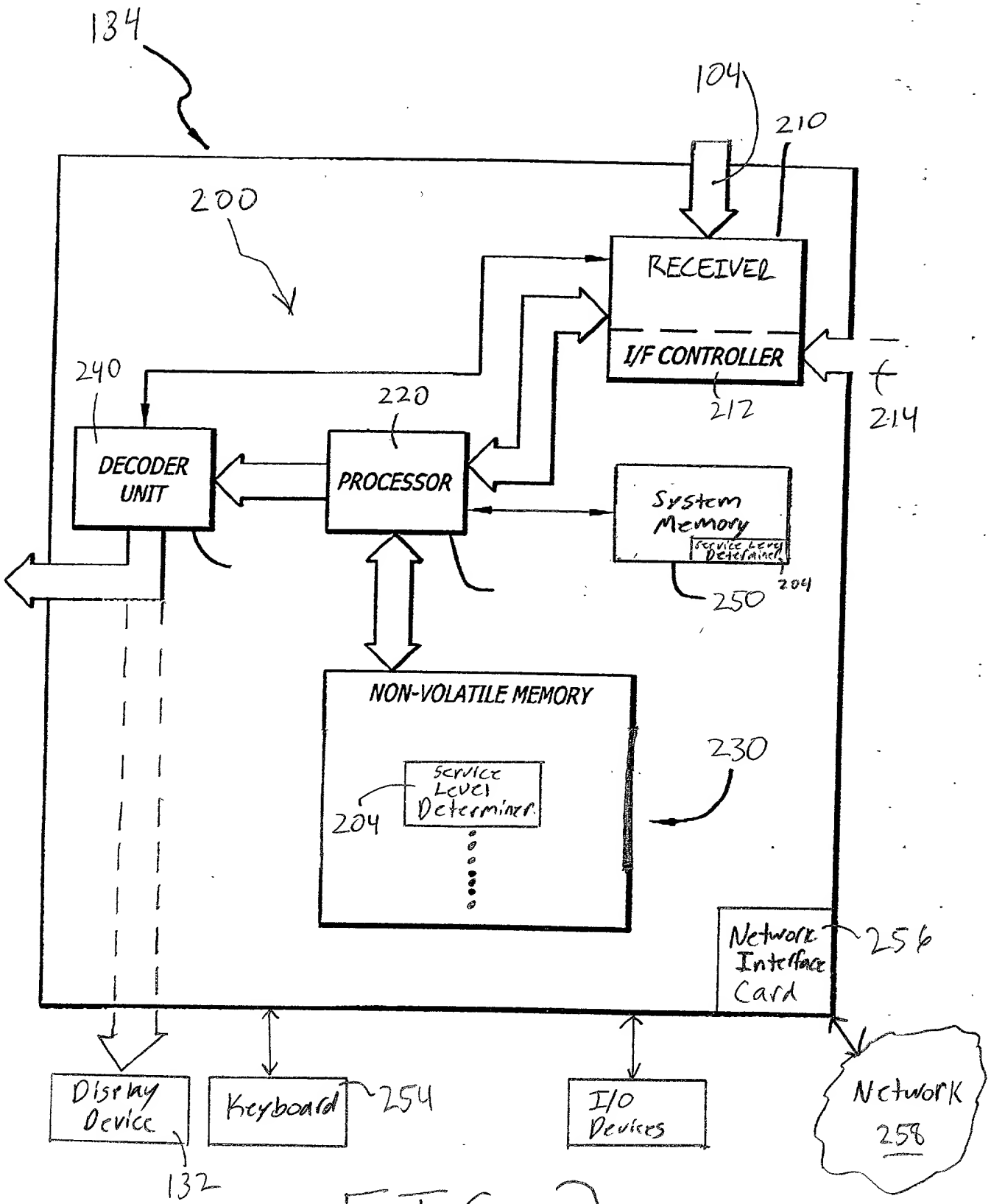
134
104
210
200
RECEIVER
I/F CONTROLLER
212
214
240
220
DECODER UNIT
PROCESSOR
System Memory
Service Level Determiner
204
250
NON-VOLATILE MEMORY
230
Service Level Determiner
204
Network Interface Card
256
Display Device
132
Keyboard
254
I/O Devices
Network
258

FIG. 2

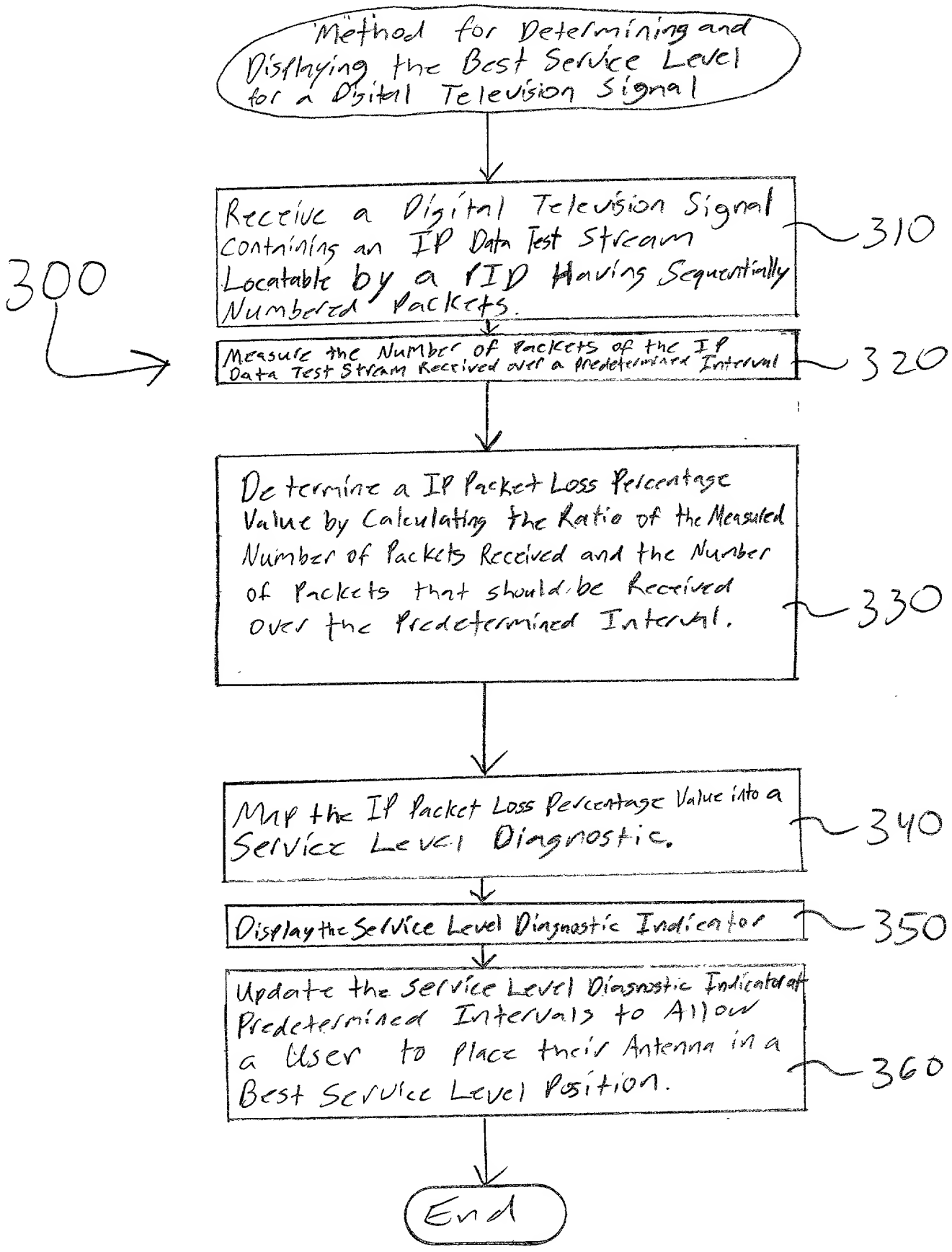
Method for Determining and Displaying the Best Service Level for a Digital Television Signal
300
Receive a Digital Television Signal containing an IP Data Test Stream Locatable by a PID Having Sequentially Numbered Packets.
310
Measure the Number of Packets of the IP Data Test Stream Received over a Predetermined Interval
320
Determine a IP Packet Loss Percentage Value by Calculating the Ratio of the Measured Number of Packets Received and the Number of Packets that should be Received over the Predetermined Interval.
330
Map the IP Packet Loss Percentage Value into a Service Level Diagnostic.
340
Display the Service Level Diagnostic Indicator
350
Update the Service Level Diagnostic Indicator at Predetermined Intervals to Allow a User to Place their Antenna in a Best Service Level Position.
360
End

FIG. 3

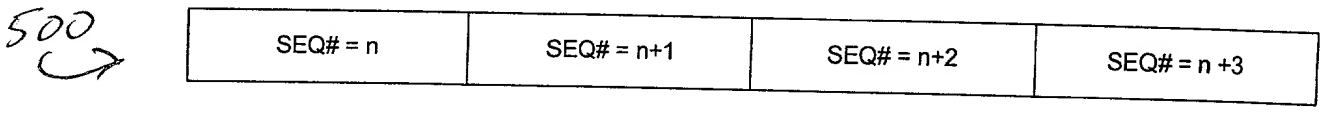
500
SEQ# = n
SEQ# = n+1
SEQ# = n+2
SEQ# = n +3

FIG. 5

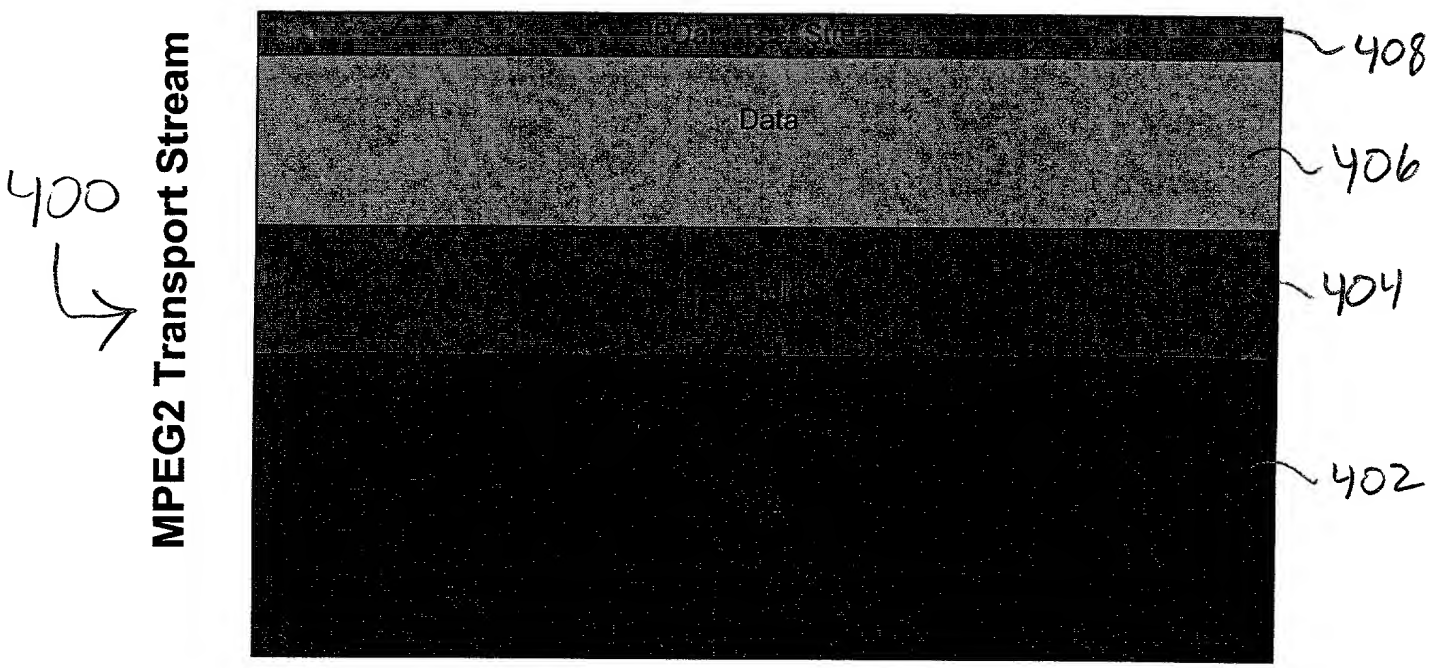
400
MPEG2 Transport Stream
Data
408
406
404
402

FIG. 4

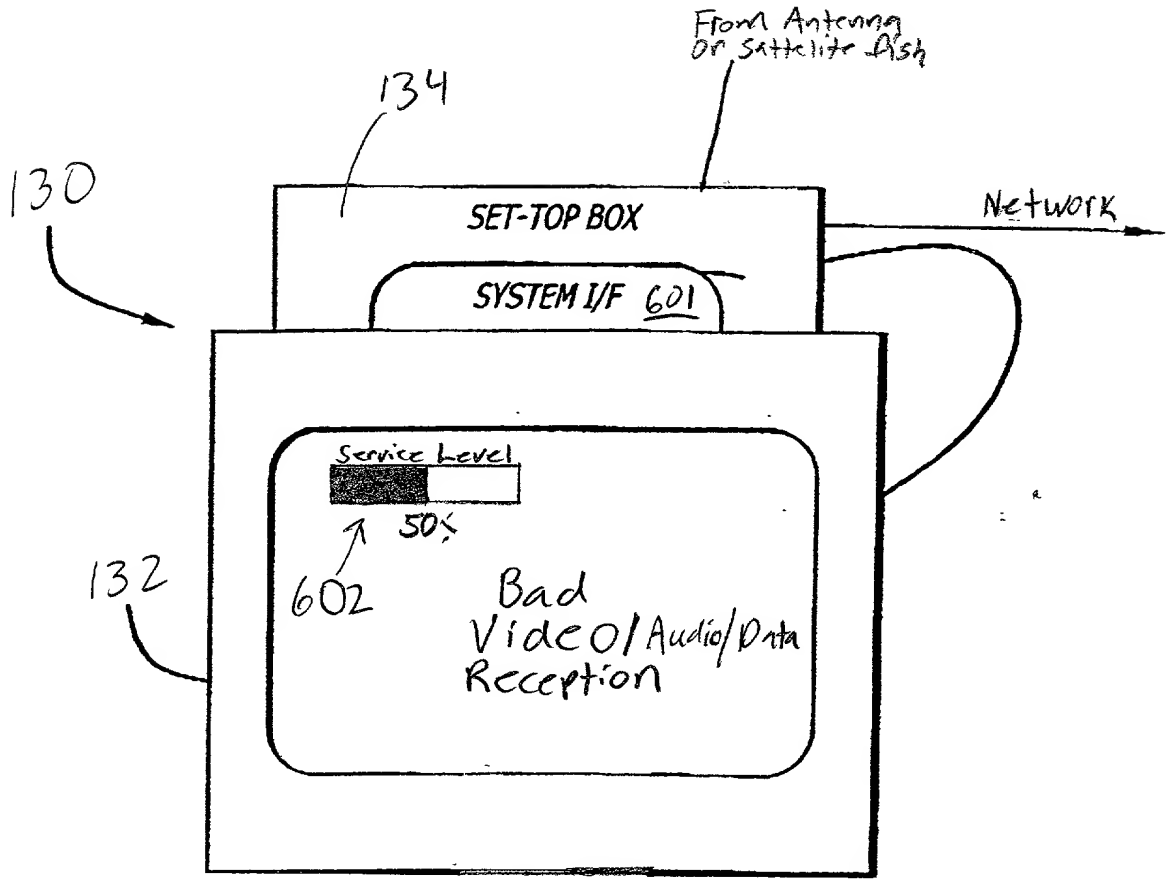
From Antenna
or Satellite Dish
134
130
SET-TOP BOX
Network
SYSTEM I/F 601
Service Level
50%
602
132
Bad
Video/Audio/Data
Reception

FIG. 6

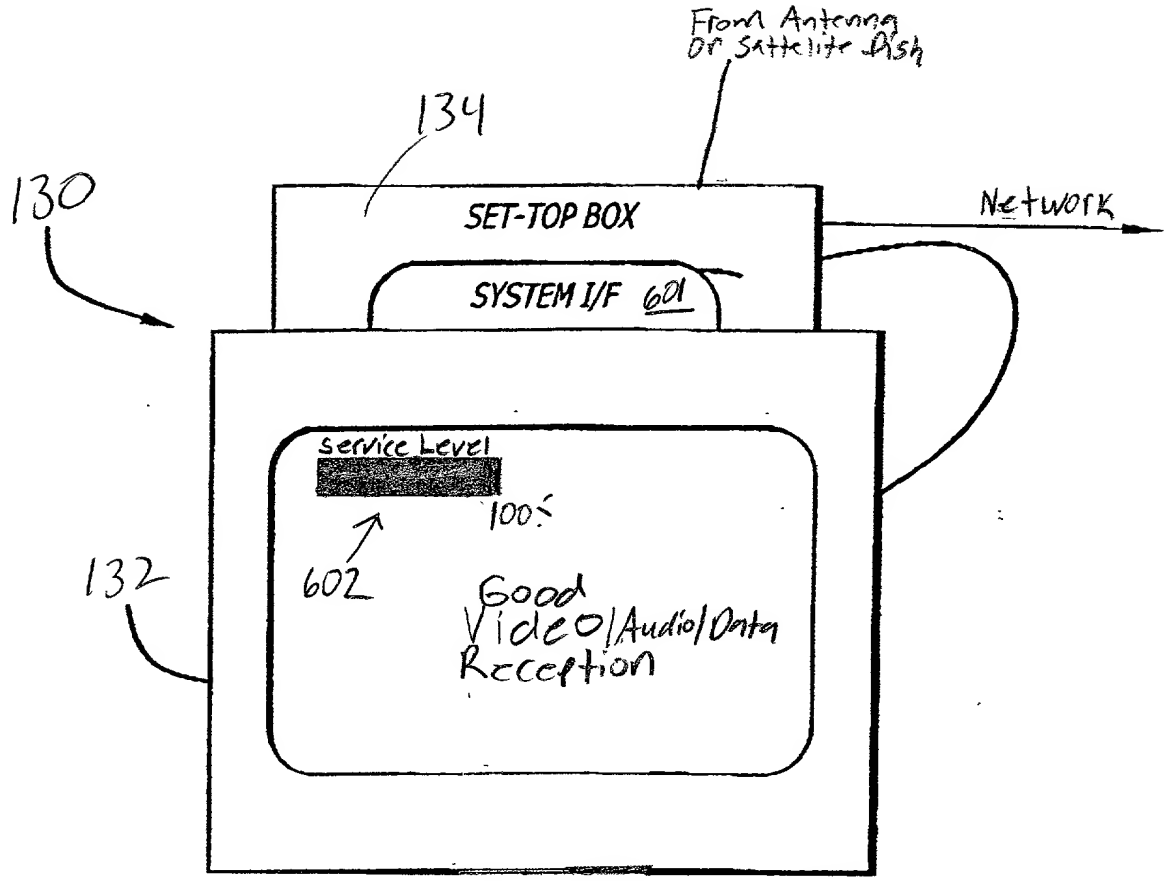
From Antenna
Or Satellite Dish
134
130
SET-TOP BOX
Network
SYSTEM I/F 601
Service Level
100%
602
132
Good
Video/Audio/Data
Reception

FIG. 7

Attorney's Docket No.: 042390.P9907

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION
(FOR INTEL CORPORATION PATENT APPLICATIONS)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND APPARATUS FOR DETERMINING AND DISPLAYING THE SERVICE LEVEL OF A DIGITAL TELEVISION BROADCAST SIGNAL

the specification of which

[X] is attached hereto.
[ ] was filed on _____ as
United States Application Number _____
or PCT International Application Number _____
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

APPLICATION NUMBER	COUNTRY (OR INDICATE IF PCT)	DATE OF FILING (day, **month**, year)	PRIORITY CLAIMED UNDER 37 USC 119
			☐ No ☐ Yes
			☐ No ☐ Yes
			☐ No ☐ Yes

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NUMBER	FILING DATE	STATUS (ISSUED, PENDING, ABANDONED)

I hereby appoint the persons listed on Appendix A hereto (which is incorporated by reference and a part of this document) as my respective patent attorneys and patent agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to:
Eric T. King, Reg. No. 44,188, BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP
(Name of Attorney or Agent)
12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025 and direct telephone calls to:
Eric T. King, (714) 557-3800.
(Name of Attorney or Agent)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole/First Inventor (given name, family name) **Curtis E. Jutzi**

Inventor's Signature _____ Date _____

Residence Lake Oswego, Oregon USA (*City, State*) Citizenship USA (*Country*)

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APPENDIX A

I hereby appoint BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, a firm including: William E. Alford, Reg. No. 37,764; Farzad E. Amini, Reg. No. 42,261; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Lisa N. Benado, Reg. No. 39,995; Bradley J. Bereznak, Reg. No. 33,474; Michael A. Bernadicou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; R. Alan Burnett, Reg. No. 46,149; Gregory D. Caldwell, Reg. No. 39,926; Andrew C. Chen, Reg. No. 43,544; Thomas M. Coester, Reg. No. 39,637; Donna Jo Coningsby, Reg. No. 41,684; Dennis M. deGuzman, Reg. No. 41,702; Stephen M. De Klerk, Reg. No. P46,503; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Sanjeet Dutta, Reg. No. P46,145; Matthew C. Fagan, Reg. No. 37,542; Tarek N. Fahmi, Reg. No. 41,402; George Fountain, Reg. No. 36,374; Paramita Ghosh, Reg. No. 42,806; James Y. Go, Reg. No. 40,621; James A. Henry, Reg. No. 41,064; Willmore F. Holbrow III, Reg. No. P41,845; Sheryl Sue Holloway, Reg. No. 37,850; George W Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; William W. Kidd, Reg. No. 31,772; Sang Hui Kim, Reg. No. 40,450; Walter T. Kim, Reg. No. 42,731; Eric T. King, Reg. No. 44,188; Erica W. Kuo, Reg. No. 42,775; George B. Leavell, Reg. No. 45,436; Gordon R. Lindeen III, Reg. No. 33,192; Jan Carol Little, Reg. No. 41,181; Kurt P. Leyendecker, Reg. No. 42,799; Joseph Lutz, Reg. No. 43,765; Michael J. Mallie, Reg. No. 36,591; Andre L. Marais, under 37 C.F.R. § 10.9(b); Paul A. Mendonsa, Reg. No. 42,879; Clive D. Menezes, Reg. No. 45,493; Chun M. Ng, Reg. No. 36,878; Thien T. Nguyen, Reg. No. 43,835; Thinh V. Nguyen, Reg. No. 42,034; Dennis A. Nicholls, Reg. No. 42,036; Daniel E. Ovanezian, Reg. No. 41,236; Kenneth B. Paley, Reg. No. 38,989; Marina Portnova, Reg. No. P45,750; William F. Ryann, Reg. 44,313; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Jeffrey S. Schubert, Reg. No. 43,098; Jeffrey Sam Smith, Reg. No. 39,377; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Judith A. Szepesi, Reg. No. 39,393; Vincent P. Tassinari, Reg. No. 42,179; Edwin H. Taylor, Reg. No. 25,129; John F. Travis, Reg. No. 43,203; Joseph A. Twarowski, Reg. No. 42,191; Thomas A. Van Zandt, Reg. No. 43,219; Lester J. Vincent, Reg. No. 31,460; Glenn E. Von Tersch, Reg. No. 41,364; John Patrick Ward, Reg. No. 40,216; Mark L. Watson, Reg. No. P46,322; Thomas C. Webster, Reg. No. P46,154; and Norman Zafman, Reg. No. 26,250; my patent attorneys, and Firasat Ali, Reg. No. 45,715; and Justin M. Dillon, Reg. No. 42,486; Raul Martinez, Reg. No. 46,904; my patent agents, of BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (714) 557-3800, and Alan K. Aldous, Reg. No. 31,905; Edward R. Brake, Reg. No. 37,784; Ben Burge, Reg. No. 42,372; Jeffrey S. Draeger, Reg. No. 41,000; Cynthia Thomas Faatz, Reg No. 39,973; John N. Greaves, Reg. No. 40,362; Seth Z. Kalson, Reg. No. 40,670; David J. Kaplan, Reg. No. 41,105; Peter Lam, Reg. No. 44,855; Charles A. Mirho, Reg. No. 41,199; Leo V. Novakoski, Reg. No. 37,198; Thomas C. Reynolds, Reg. No. 32,488; Kenneth M. Seddon, Reg. No. 43,105; Mark Seeley, Reg. No. 32,299; Steven P. Skabrat, Reg. No. 36,279; Howard A. Skaist, Reg. No. 36,008; Gene I. Su, Reg. No. 45,140; Calvin E. Wells, Reg. No. P43,256, Raymond J. Werner, Reg. No. 34,752; Robert G. Winkle, Reg. No. 37,474; Steven D. Yates, Reg. No. 42,242; and Charles K. Young, Reg. No. 39,435, my patent agents, of INTEL CORPORATION; and James R. Thein, Reg. No. 31,710, my patent attorney; with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

United States Patent & Trademark Office

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